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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the adhesion method of the lubricant for maintaining transmission performances, such as an optical image, without spoiling the flexibility of an optical fiber bunch.

[0002]

[Description of the Prior Art] Generally, the flexible optical fiber bunch for image transmission is used for the endoscope. Since this optical fiber bunch is inserted in the endoscope insertion circles which it is inserted into a coelome and can be bent free, the pars intermedia except the both ends has flexibility. Moreover, since this optical fiber bunch transmits without producing disorder of a picture from one end face in an other-end side, an alignment array is carried out in the position as for which one end face and other-end side of each fiber which constitutes an optical fiber bunch carry out phase correspondence, and the both ends of this optical fiber bunch are rigid.

[0003] These both ends are rigid, and the optical fiber bunch in which middle has flexibility carries out the two or more alignment array of the optical fiber strand which formed acid dissolution glass in the optical fiber which consists of a core and clad as an outermost layer of drum, carries out heat welding of each other, and forms a parent conduit tube. Next, a conduit-tube-like optical fiber bunch is formed, heating extension of this parent conduit tube is carried out, after covering the both ends of this optical fiber bunch with an acid-proof material, it is immersed into an acid, and dissolution removal of the acid dissolution glass of the pars intermedia except these both ends is carried out, and pars intermedia is constituted by flexibility.

[0004] Neutralization processing is carried out in an alkali solution, and the optical fiber bunch by which dissolution removal of this pars intermedia was carried out washes in cold water, is replaced by water in ethyl alcohol, carries out swelling removal of the acid-proof material which covered both ends in an acetone, carries out substitution processing in ethyl alcohol further, carries out dryness removal of the acetone solvent, and constitutes pars intermedia. And adhesives are filled up with and reinforced on the boundary of the rigid section of both ends, and flexible pars intermedia.

[0005] By the way, it is made to decrease so that ** ON may not be carried out into the fiber of others [light / which leaked when the light leak from one fiber / one / was prevented while, as for a such optical fiber bunch, the solid lubricant was applied to the one fiber / one /, and slipping of fiber was improved, and the blemish was attached to fiber or making it a crease not arise, and light leaked further].

[0006] As a method of applying lubricant to this optical fiber bunch, dispersants, such as chlorofluocarbon, were made to distribute solid lubricants, such as molybdenum disulfide, and it considered as application liquid, and this application liquid was applied to the optical fiber bunch, the evaporation evaporation of the dispersant was carried out after that, and molybdenum disulfide was made to adhere to an optical fiber bunch.

[0007] However, as a dispersant of application liquid, the alternative to a dispersant noncombustible by ** chlorofluocarbon from environment and the field of safety has been needed. 25l. [of distilled water] and emulgen 60cc, the solution of 2.5kg of molybdenum disulfide, or the distributed solution that added 500g of molybdenum disulfide into 18l. of perchloroethylenes was

used as one of them.

[0008]

[Problem(s) to be Solved by the Invention] This optical fiber bunch is arranged in an endoscope, it is used, and washing disinfection accomplishes the endoscope itself. When it is performed recently that peroxide system sterilization is given on the occasion of this disinfection and this peroxide system sterilization agent and molybdenum disulfide contacted, molybdenum disulfide oxidized, became a staining substance and had the problem of corroding the coil in an endoscope etc. violently.

[0009] By the adhesion method using above-mentioned distilled water, fiber absorbs moisture and tends to absorb water, as a result, fiber adheres, lubricity falls, flexibility becomes bad, and it is easy to generate a crease. Moreover, in the duster distance which equalizes this coating weight, in order for there to be moisture absorption and absorptivity, it cooked, and the crease might occur and lubricant might be omitted in distance.

[0010] A perchloroethylene makes the adhesives which reinforce the boundary of the rigid section of the both ends of an optical fiber bunch with the adhesion method using the perchloroethylene dissolve and swell, a crease occurs in optical fiber, and it may be able to stop moreover, might be unable to use it as optical fiber for image transfer. Moreover, the perchloroethylene was detrimental to the human body and was not desirable as a work environment.

[0011] this invention was made in view of these situations, and enlarges the front face of optical fiber, and the degree of wetting angle of the water of lubricant. Moisture absorption, Prevent water absorption, and raise lubrication and the lubrication effect, and prevent the fall of lubrication and the lubrication effect, and a crease of optical fiber is lost. And the duster distance which shorten the drying time, and lubricant is made to adhere to optical fiber uniformly further, and removes excessive lubricant can be abolished. It enables it to lose the dissolution of adhesives which has reinforced the rigid section boundary of both ends, and swelling, and aims at offering the lubricant adhesion method of an optical fiber bunch of having high stability to peroxide system sterilization.

[0012] Moreover, other purposes of this invention give a lubricous polymer thin film coat to the front face of this fiber, and are to offer the adhesion method of the lubricant of an optical fiber bunch of having enabled it to prevent moisture absorption and water absorption further while they adhere lubricant to each fiber of an optical fiber bunch.

[0013] Moreover, another purpose of this invention is to offer the adhesion method of the lubricant of an optical fiber bunch of using neither a solvent with the destruction nature to ozone layers, such as chlorofluorocarbon, nor a solvent with inflammabilities, such as a low-molecular-weight polyorganosiloxane.

[0014]

[Means for Solving the Problem] In order to attain the aforementioned purpose, the lubricant adhesion method of the optical fiber bunch by this invention Mix a lubricous polymer agent and carbon lubricant into the solvent containing low-molecular-weight perfluoro carbon or the low-molecular-weight perfluoro ether, and a distributed solution is made. It carries out being predetermined-time immersed of the optical fiber bunch into this solution, and a lubricous polymer thin film coat and carbon lubricant are made to adhere, the optical fiber bunch is taken out out of the aforementioned solution, the dryness evaporation of the solvent is carried out, and carbon lubricant is made to adhere to homogeneity mostly.

[0015] By this adhesion method, the lubricous polymer thin film coat and carbon lubricant adhering to optical fiber and this optical fiber can prevent moisture absorption and water absorption, and can improve the lubrication effect. Moreover, since low-molecular-weight perfluoro carbon or the low-molecular-weight perfluoro ether is used as a solvent which distributes a lubricous polymer agent and carbon lubricant, it is possible to aim at shortening of the drying time, moreover, a lubricous polymer agent and carbon lubricant are uniformly distributed in low-molecular-weight perfluoro carbon or the low-molecular-weight perfluoro ether, and the duster process which removes the carbon lubricant which adhered too much from adhering to each optical fiber uniformly can be abolished. Moreover, since carbon lubricant is used, in order that the

bad influence of a staining substance occurring to peroxide system sterilization may not come out, the high stability over peroxide system sterilization is shown.

[0016] Moreover, since its toxicity is very low and it does not contain chlorine to a human body, low-molecular-weight perfluoro carbon or the low-molecular-weight perfluoro ether does not have destruction of an ozone layer, either, and since it is incombustibility further, safety is high [the ether] to a human body and environment. Moreover, since this solvent does not contain water, moisture absorption of optical fiber and water absorption are not almost, and there is little generating of a crease of optical fiber. Furthermore, since this solvent has the very weak attack nature to a resin, it does not dissolve the adhesives with which the rigid section boundary of the edge of an optical fiber bunch is reinforced, or is not made to swell them.

[0017]

[Embodiments of the Invention] While making the solvent of low-molecular-weight perfluoro carbon carry out mixing distribution of the carbon as lubricant, the distributed solution which distributed the fluorine system homopolymer dispersant for forming a lubricous polymer thin film coat is made from the form of operation of the 1st of this invention. Next, it carries out being predetermined-time immersed of the optical fiber bunch into this distributed solution. Both ends are rigid, pars intermedia has flexibility, and the optical fiber bunch used here fills up the boundary of the rigid section and the flexible section with adhesives, and is reinforced.

[0018] When an optical fiber bunch is immersed into this distributed solution, lubricous polymer coating is given to the front face of each optical fiber, and carbon adheres to the front face of this lubricous polymer coating uniformly further. Then, an optical fiber bunch is taken out out of a solution, the dryness evaporation of the low-molecular-weight perfluoro carbon is carried out from this optical fiber bunch, lubricous polymer coating is formed in an optical fiber front face, and the optical fiber bunch by which the front face of this lubricous polymer coating adhered to carbon uniformly further can be made.

[0019] By the optical fiber bunch manufactured by the method of this 1st operation form, when fluorine system homopolymer coating is given to each optical fiber front face which forms an optical fiber bunch and carbon adheres uniformly further, a lubrication function can be improved, or moisture absorption water absorption is prevented, the fall of a lubrication function is prevented, and-izing of the crease of optical fiber can be carried out [****]. Moreover, a circumference portion is not corroded, although the corrosive matter is not generated and it incorporates in an endoscope, even if it faces implementation of peroxide system sterilization, since carbon is used as lubricant and the sulfide is not included.

[0020] Moreover, as a solvent which distributes a lubricous polymer agent and lubricant, since low-molecular-weight perfluoro carbon is used, the dissolution of adhesives which has reinforced the rigid section boundary of the both ends of an optical fiber bunch, and swelling can be lost. Moreover, by the method of the form the 1st operation, the drying time can be shortened, and since low-molecular-weight perfluoro carbon does not contain water, it can enlarge the degree of wetting angle with water, can prevent moisture absorption and water absorption, can improve a lubrication function, and can prevent a crease of optical fiber.

[0021] Moreover, since lubricant can be made to be able to adhere to optical fiber uniformly and excessive lubricant cannot be made to adhere, the duster process which removes excessive lubricant can be abolished. Moreover, by the lubricous polymer thin film coat and lubricant which adhered to the front face of each optical fiber uniformly, an optical leak can be prevented and the fall of the communicative function of an optical image can be prevented.

[0022] Furthermore, since its toxicity is very low and it does not contain chlorine to a human body, the low-molecular-weight perfluoro carbon as a solvent does not have destruction of an ozone layer, either, and since it is incombustibility, safety is very high [carbon] to a human body and environment. In addition, it may replace with low-molecular-weight perfluoro carbon, and a low-molecular-weight perfluoro polyether may be used.

[0023] While making the solvent of low-molecular-weight perfluoro carbon carry out mixing distribution of the carbon as lubricant, the distributed solution which distributed the fluorine system oil dispersant for forming a lubricous polymer thin film coat is made from the 2nd

operation form. Next, it carries out being predetermined-time immersed of the optical fiber bunch same with having used with the 1st operation form into this distributed solution.

[0024] When an optical fiber bunch is immersed into this distributed solution, lubricous polymer coating of fluorine system oil is given to the front face of each optical fiber, and carbon adheres to the front face of this lubricous polymer coating uniformly further.

[0025] Then, an optical fiber bunch is taken out out of a solution, the dryness evaporation of the low-molecular-weight perfluoro carbon is carried out from this optical fiber bunch, lubricous polymer coating of fluorine system oil is formed in an optical fiber front face, and the optical fiber bunch by which the front face of this lubricous polymer coating adhered to carbon uniformly further can be made.

[0026] Using ethyl alcohol or an acetone as a surface treatment liquid creation medium, this solvent is made to carry out mixing distribution of the Nonion system surfactant as a lubricous polymer agent, and a surface treatment solution is made from the 3rd operation form. By carrying out being predetermined-time immersed of the optical fiber bunch into this solution, a surfactant adheres to the front face of each optical fiber uniformly. The optical fiber bunch used here has rigid both ends, and pars intermedia has flexibility.

[0027] Then, an optical fiber bunch can be taken out out of a solution, the vacuum-drying evaporation of the ethyl alcohol can be carried out from this optical fiber bunch, and the optical fiber bunch by which surfactant coating was uniformly given to the optical fiber bunch front face can be made. Next, the rigid section boundary of the both ends of this optical fiber bunch is reinforced with adhesives.

[0028] Furthermore, using low-molecular-weight perfluoro carbon as a solvent, this solvent is made to carry out mixing distribution of the carbon as lubricant, and a distributed solution is made. By carrying out being predetermined-time immersed of the optical fiber bunch into this solution, carbon adheres to the front face of each optical fiber uniformly. Then, an optical fiber bunch can be taken out out of a solution, the dryness evaporation of the low-molecular-weight perfluoro carbon can be carried out from this optical fiber bunch, and the optical fiber bunch by which the front face of surfactant coating on the front face of optical fiber adhered to carbon uniformly further can be made.

[0029] By the optical fiber bunch manufactured by the method of this 3rd operation form, when surfactant coating is given to each optical fiber front face which forms an optical fiber bunch and carbon adheres uniformly further, a lubrication function can be improved, or moisture absorption water absorption is prevented, the fall of a lubrication function is prevented, and-izing of the crease of optical fiber can be carried out [****].

[0030] Moreover, the ethyl alcohol used by the method of this 3rd operation form as a solvent which distributes a lubricous polymer agent, An acetone is what is used as a water substitution solvent by the optical fiber bunch manufacturing process. Since low-molecular-weight perfluoro carbon is used as a solvent which it is performed [solvent] after restoration of the adhesives with which the rigid section boundary of optical fiber bunch both ends is reinforced performs lubricous polymer agent coating processing, and distributes lubricant The dissolution of adhesives which has reinforced the rigid section boundary of the both ends of an optical fiber bunch, and swelling can be lost.

[0031] Moreover, according to the method of this 3rd operation form, the drying time can be shortened, and since ethyl alcohol and low-molecular-weight perfluoro carbon do not contain water, they can enlarge the degree of wetting angle with water, can prevent moisture absorption water absorption, can improve a lubrication function, and can prevent a crease of optical fiber.

[0032] Moreover, since lubricant can be made to be able to adhere to optical fiber uniformly and excessive lubricant cannot be made to adhere, the duster process which removes excessive lubricant can be abolished. Moreover, by the lubricous polymer thin film coat and lubricant which adhered to the front face of each optical fiber uniformly, an optical leak can be prevented and the fall of the communicative function of an optical image can be prevented.

[0033] Furthermore, since its toxicity is very low and it does not contain chlorine to a human body, the low-molecular-weight perfluoro carbon as a solvent used for the method of the 3rd operation

form does not have destruction of an ozone layer, either, and since it is incombustibility, safety is very high [carbon] to a human body and environment. In addition, you may make it apply an optical fiber bunch to the flow of a distributed solution instead of adhering the lubricant which carried out being fixed time immersed of the optical fiber into the distributed solution which carried out mixing distribution of the lubricant, and may make it sprinkle a distributed solution in an optical fiber bunch. Moreover, the lubricant adhesion method of this optical fiber bunch is also applicable to the light guide which transmits not only the image guide that has the flexibility which transmits an optical image but lighting light.

[0034] With the 4th operation form, mixing distribution of the Nonion system surfactant is carried out as a lubricous polymer agent into this solvent, the carbon as lubricant is stirred, and added, distributed and dried [filter and] further, using dimethylsiloxane as a solvent for pretreating lubricant, and lubricant processed [lubricant] is created.

[0035] Next, using ethyl alcohol as a surface treatment liquid creation medium, this solvent is made to carry out mixing distribution of the Nonion system surfactant as a lubricous polymer agent, and a surface treatment solution is made. By carrying out being predetermined-time immersed of the optical fiber bunch into this solution, a surfactant adheres to the front face of each optical fiber uniformly. The optical fiber bunch used here has rigid both ends, and pars intermedia has flexibility. In addition, as a surface treatment liquid creation medium, you may use an acetone.

[0036] Then, an optical fiber bunch can be taken out out of a solution, the vacuum-drying evaporation of the ethyl alcohol can be carried out from this optical fiber bunch, and the optical fiber bunch by which surfactant coating was uniformly given to the optical fiber bunch front face can be made. Next, the rigid section boundary of the both ends of this optical fiber bunch is reinforced with adhesives.

[0037] Furthermore, using low-molecular-weight perfluoro carbon as a solvent, this solvent is made to carry out mixing distribution of the carbon of lubricant pretreated [lubricant], and a distributed solution is made. By carrying out being predetermined-time immersed of the optical fiber bunch into this solution, carbon processed [lubricant] adheres to the front face of each optical fiber uniformly. Then, an optical fiber bunch can be taken out out of a solution, the dryness evaporation of the low-molecular-weight perfluoro carbon can be carried out from this optical fiber bunch, and the optical fiber bunch by which the front face of surfactant coating on the front face of optical fiber adhered to carbon processed [lubricant] uniformly further can be made. This 4th operation gestalt has the same effect as the 3rd operation gestalt.

[0038]

[Example]

The 1st example of the 1st example makes the distributed solution which distributed the fluorine system homopolymer dispersant for creating a lubricous polymer thin film coat from the following rates while making this solvent carry out mixing distribution of the carbon as lubricant about the 1st operation gestalt, using FURORINATO (product made from Sumitomo 3M) as low-molecular-weight perfluoro carbon.

carbon 0.5-10g FURORINATO 11. Fluorad 0.01-1 cc (here -- FURORINATO -- a perfluoro carbon solvent -- it is -- the product made from Sumitomo 3M ---F5050, and PF5052, PF5060, PF5070 and PF5080 -- it is -- Fluorad -- a fluorine system homopolymer dispersant -- it is -- the product made from Sumitomo 3M -- it is :FC-722)

[0039] When an optical fiber bunch is immersed into this distributed solution, lubricous polymer coating of a fluorine system homopolymer is given to the front face of each optical fiber, and carbon adheres to the front face of this lubricous polymer coating uniformly further. It is not limited to FURORINATO which is low-molecular-weight perfluoro carbon as a solvent in the 1st example of the above, and the girl ten which is a low-molecular-weight perfluoro polyether may be used.

[0040] The 2nd example of the 2nd example is FOMBLIN about the 2nd operation gestalt as fluorine system oil for forming carbon, low-molecular-weight perfluoro carbon, and a lubricous polymer thin film coat. A distributed solution is made from the following rates using Y25 (AUSIMONT make : nonvolatile perfluoro polyether oil).

Carbon 0.5-10g low-molecular-weight perfluoro carbon 11. FOMBLIN Y25 When 0.01-1 cc optical fiber bunch is immersed into this distributed solution, lubricous polymer coating of fluorine system oil is given to the front face of each optical fiber, and carbon adheres to the front face of this lubricous polymer coating uniformly further.

[0041] It is die furoyl about the operation gestalt of the 3rd example 2nd of the 3rd example as fluorine system oil for forming carbon, low-molecular-weight perfluoro carbon, and a lubricous polymer thin film coat. A distributed solution is made from the following rates using #10 (Daikin Industries make : low-molecular Ryoze fluoride salt-sized ethylene).

Carbon 0.5-10g low-molecular-weight perfluoro carbon 11. die furoyl #10 When 0.01-1 cc optical fiber bunch is immersed into this distributed solution, lubricous polymer coating of fluorine system oil is given to the front face of each optical fiber, and carbon adheres to the front face of this lubricous polymer coating uniformly further.

[0042] The 4th example of the 4th example is related with the 3rd operation gestalt. Using ethyl alcohol as a surface treatment liquid creation solvent, this solvent is made to carry out mixing distribution of the Nonion system surfactant at following rate as a lubricous polymer agent, and surface treatment liquid is made from this 4th example.

Ethyl alcohol 11. emulgen 404 The rigid section boundary of the both ends of an optical fiber bunch where the front face of each optical fiber was uniformly coated with the surfactant is reinforced with adhesives by carrying out being predetermined-time immersed of the optical fiber bunch into the above-mentioned surface treatment solution after that [0.01-1 cc (here, emulgen 404 is Nonion system surfactant and is Kao make.)].

[0043] Furthermore, using FURORINATO (product made from Sumitomo 3M) as low-molecular-weight perfluoro carbon, this solvent is made to carry out mixing distribution of the carbon as lubricant, and a distributed solution is made from the following rates.

carbon 0.5-10g FURORINATO 11. (here -- FURORINATO -- a low-molecular-weight perfluoro carbon solvent -- it is -- the product made from Sumitomo 3M -- it is-F5050, and PF5052, PF5060, PF5070 and PF5080)

[0044] By carrying out being predetermined-time immersed of the optical fiber bunch into this distributed solution, carbon adheres to the surfactant coating front face of each optical fiber uniformly. It is not limited to FURORINATO which is low-molecular-weight perfluoro carbon as a solvent in the 4th example, and the girl ten which is a low-molecular-weight perfluoro polyether may be used.

[0045] The 5th example of the 5th example is related with the 4th operation gestalt. Dimethylsiloxane is used as a solvent as pretreatment of the carbon which is lubricant, and this solvent is made to carry out mixing distribution of the Nonion system surfactant at following rate as a lubricous polymer agent, and it makes from this 5th example.

Carbon 10-100gEE3310 200 cc emulgen 404 0.01-1 cc (here, EE3310 is dimethylsiloxane, and emulgen 404 is a Nonion system surfactant and it is the Kao make)

[0046] Next, this solvent is made to carry out mixing distribution of the Nonion system surfactant at following rate as a lubricous polymer agent, using ethyl alcohol as a surface treatment liquid creation solvent.

Ethyl alcohol 11. emulgen 404 A surfactant adheres to the front face of each optical fiber uniformly after that [0.01-1 cc] by carrying out being predetermined-time immersed of the optical fiber bunch into the above-mentioned surface treatment solution. This optical fiber bunch is taken out out of a surface treatment solution, the optical fiber bunch by which the vacuum-drying evaporation of the ethyl alcohol was carried out, and the optical fiber front face was uniformly coated with the surfactant is made, and the rigid section boundary of the both ends of the optical fiber bunch is reinforced with adhesives.

[0047] Furthermore, using FURORINATO (product made from Sumitomo 3M) as low-molecular-weight perfluoro carbon, this solvent is made to carry out mixing distribution of the carbon of lubricant processed [lubricant], and a distributed solution is made from the following rates. lubricating-treatment finishing carbon 0.5-10g FURORINATO By carrying out being predetermined-time immersed of the 11. (here -- FURORINATO -- a perfluoro carbon solvent -- it

being -- the product made from Sumitomo 3M -- it being-F5050, and PF5052, PF5060, PF5070 and PF5080) of the optical fiber bunches into this distributed solution, carbon processed [lubricant] adheres to the surfactant coating front face of each optical fiber uniformly. In addition, it is not limited to FURORINATO which is low-molecular-weight perfluoro carbon as a solvent in the 5th example, and the girl ten which is a low-molecular-weight perfluoro polyether may be used.

[0048]

[Effect of the Invention] As explained above, according to this invention, the front face of optical fiber and the degree of wetting angle of the water of lubricant can be enlarged, moisture absorption water absorption can be prevented, and the lubrication effect can be raised, or the fall of the lubrication effect can be prevented, and a crease for fiber can be lost. And the drying time is shortened and the duster process which lubricant is made to adhere to optical fiber uniformly further, and removes excessive lubricant can be abolished. Moreover, the dissolution of adhesives which has reinforced the rigid section boundary of both ends, and swelling can be lost. Furthermore, the created optical fiber bunch is effective in having the high stability over peroxide system sterilization.

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EXAMPLE

[Example]

The 1st example of the 1st example makes the distributed solution which distributed the fluorine system homopolymer dispersant for creating a lubricous polymer thin film coat from the following rates while making this solvent carry out mixing distribution of the carbon as lubricant about the 1st operation gestalt, using FURORINATO (product made from Sumitomo 3M) as low-molecular-weight perfluoro carbon.

carbon 0.5-10g FURORINATO 11. Fluorad 0.01-1 cc (here -- FURORINATO -- a perfluoro carbon solvent -- it is -- the product made from Sumitomo 3M ---F5050, and PF5052, PF5060, PF5070 and PF5080 -- it is -- Fluorad -- a fluorine system homopolymer dispersant -- it is -- the product made from Sumitomo 3M -- it is :FC-722)

[0039] When an optical fiber bunch is immersed into this distributed solution, lubricous polymer coating of a fluorine system homopolymer is given to the front face of each optical fiber, and carbon adheres to the front face of this lubricous polymer coating uniformly further. It is not limited to FURORINATO which is low-molecular-weight perfluoro carbon as a solvent in the 1st example of the above, and the girl ten which is a low-molecular-weight perfluoro polyether may be used.

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Carbon 0.5-10g low-molecular-weight perfluoro carbon 11. FOMBLIN Y25 When 0.01-1 cc optical fiber bunch is immersed into this distributed solution, lubricous polymer coating of fluorine system oil is given to the front face of each optical fiber, and carbon adheres to the front face of this lubricous polymer coating uniformly further.

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[0042] The 4th example of the 4th example is related with the 3rd operation gestalt. Using ethyl alcohol as a surface treatment liquid creation solvent, this solvent is made to carry out mixing distribution of the Nonion system surfactant at following rate as a lubricous polymer agent, and surface treatment liquid is made from this 4th example.

Ethyl alcohol 11. emulgen 404 The rigid section boundary of the both ends of an optical fiber bunch where the front face of each optical fiber was uniformly coated with the surfactant is reinforced with adhesives by carrying out being predetermined-time immersed of the optical fiber bunch into the above-mentioned surface treatment solution after that [0.01-1 cc (here, emulgen 404 is Nonion system surfactant and is Kao make.)].

[0043] Furthermore, using FURORINATO (product made from Sumitomo 3M) as low-molecular-

weight perfluoro carbon, this solvent is made to carry out mixing distribution of the carbon as lubricant, and a distributed solution is made from the following rates.

carbon 0.5-10g FURORINATO 11. (here -- FURORINATO -- a low-molecular-weight perfluoro carbon solvent -- it is -- the product made from Sumitomo 3M -- it is-F5050, and PF5052, PF5060, PF5070 and PF5080)

[0044] By carrying out being predetermined-time immersed of the optical fiber bunch into this distributed solution, carbon adheres to the surfactant coating front face of each optical fiber uniformly. It is not limited to FURORINATO which is low-molecular-weight perfluoro carbon as a solvent in the 4th example, and the girl ten which is a low-molecular-weight perfluoro polyether may be used.

[0045] The 5th example of the 5th example is related with the 4th operation gestalt.

Dimethylsiloxane is used as a solvent as pretreatment of the carbon which is lubricant, and this solvent is made to carry out mixing distribution of the Nonion system surfactant at following rate as a lubricous polymer agent, and it makes from this 5th example.

Carbon 10-100gEE3310 200 cc emulgen 404 0.01-1 cc (here, EE3310 is dimethylsiloxane, and emulgen 404 is a Nonion system surfactant and it is the Kao make)

[0046] Next, this solvent is made to carry out mixing distribution of the Nonion system surfactant at following rate as a lubricous polymer agent, using ethyl alcohol as a surface treatment liquid creation solvent.

Ethyl alcohol 11. emulgen 404 A surfactant adheres to the front face of each optical fiber uniformly after that [0.01-1 cc] by carrying out being predetermined-time immersed of the optical fiber bunch into the above-mentioned surface treatment solution. This optical fiber bunch is taken out out of a surface treatment solution, the optical fiber bunch by which the vacuum-drying evaporation of the ethyl alcohol was carried out, and the optical fiber front face was uniformly coated with the surfactant is made, and the rigid section boundary of the both ends of the optical fiber bunch is reinforced with adhesives.

[0047] Furthermore, using FURORINATO (product made from Sumitomo 3M) as low-molecular-weight perfluoro carbon, this solvent is made to carry out mixing distribution of the carbon of lubricant processed [lubricant], and a distributed solution is made from the following rates. lubricating-treatment finishing carbon 0.5-10g FURORINATO By carrying out being predetermined-time immersed of the 11. (here -- FURORINATO -- a perfluoro carbon solvent -- it being -- the product made from Sumitomo 3M -- it being-F5050, and PF5052, PF5060, PF5070 and PF5080) of the optical fiber bunches into this distributed solution, carbon processed [lubricant] adheres to the surfactant coating front face of each optical fiber uniformly. In addition, it is not limited to FURORINATO which is low-molecular-weight perfluoro carbon as a solvent in the 5th example, and the girl ten which is a low-molecular-weight perfluoro polyether may be used.

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CLAIMS

[Claim(s)]

[Claim 1] The lubricant adhesion method of the optical fiber bunch characterized by providing the following. The distributed solution generation step which carries out mixing distribution of carbon lubricant and the lubricous polymer into the solvent containing low-molecular-weight perfluoro carbon or a low-molecular-weight perfluoro polyether, and makes a distributed solution. The aforementioned distributed solution is contacted on the strand front face of an optical fiber bunch on which both ends are rigid and pars intermedia has flexibility. The adhesion step which the aforementioned lubricous polymer thin film coat is given [step] to the front face of each optical fiber which forms the aforementioned optical fiber bunch, and makes carbon lubricant adhere to homogeneity mostly on the aforementioned lubricous polymer thin film coat further, The dryness step dried so that the aforementioned solvent may be made to evaporate from the optical fiber bunch after the aforementioned adhesion step and the aforementioned lubricous polymer thin film coat and the aforementioned carbon lubricant may adhere to the front face of each optical fiber mostly at homogeneity.

[Claim 2] The aforementioned distributed solution is the lubricant adhesion method of the carbon lubricant [0.5-10g] optical fiber bunch according to claim 1 which comes out comparatively and is characterized by a certain thing to the perfluoro carbon or 11. of perfluoro polyethers of low molecular weight.

[Claim 3] The aforementioned lubricous polymer agent is the lubricant adhesion method of the optical fiber bunch according to claim 1 characterized by being a fluorine system homopolymer.

[Claim 4] The aforementioned lubricous polymer agent is the lubricant adhesion method of the optical fiber bunch according to claim 1 characterized by being perfluoro polyether oil.

[Claim 5] The aforementioned lubricous polymer agent is the lubricant adhesion method of the optical fiber bunch according to claim 1 characterized by being low-molecular Ryoze fluoride salt-ized ethylene.

[Claim 6] The aforementioned lubricous polymer agent is the lubricant adhesion method of the optical fiber bunch according to claim 1 characterized by being a Nonion system surfactant.

[Claim 7] [whether the aforementioned adhesion step is immersed in the aforementioned optical fiber bunch into the aforementioned distributed solution, and the aforementioned distributed solution is contacted on the front face of the aforementioned optical fiber bunch, and] The lubricant adhesion method of the optical fiber bunch according to claim 1 characterized by applying the aforementioned optical fiber bunch to the flow of the aforementioned distributed solution, contacting the aforementioned distributed solution on the front face of the aforementioned optical fiber bunch, or sprinkling the aforementioned distributed solution in the aforementioned optical fiber bunch, and contacting the aforementioned distributed solution on the front face of the aforementioned optical fiber bunch.

[Claim 8] The lubricant adhesion method of the optical fiber bunch characterized by providing the following. The surface treatment solution generation step which makes the solution which carried out the homogeneous dissolution of the lubricous polymer agent into the solvent. The 1st adhesion step for both ends being rigid and making it the front face of each optical fiber which the aforementioned surface treatment solution is contacted on the strand front face of an optical fiber

bunch on which pars intermedia has flexibility, and forms the aforementioned optical fiber bunch in it adhere to the aforementioned lubricous polymer thin film coat mostly at homogeneity. The dryness step dried so that the aforementioned solvent may be made to evaporate from the optical fiber bunch after the adhesion step of the above 1st and the aforementioned lubricous polymer may be made to adhere to the front face of each optical fiber mostly at homogeneity. The distributed solution generation step which makes the distributed solution which carried out mixing distribution of the carbon lubricant in low-molecular-weight perfluoro carbon or a low-molecular-weight perfluoro polyether solvent, The 2nd adhesion step for making it the front face of an optical fiber bunch on which the aforementioned lubricous polymer adhered to homogeneity mostly adhere to the aforementioned carbon lubricant mostly at homogeneity, The dryness step dried so that the aforementioned solvent may be made to evaporate from the optical fiber bunch after the adhesion step of the above 2nd and the aforementioned carbon lubricant may be made to adhere to the front face of each optical fiber mostly at homogeneity.

[Claim 9] The solvent of the aforementioned surface treatment solution is the lubricant adhesion method of the optical fiber bunch according to claim 8 characterized by being ethyl alcohol.

[Claim 10] The solvent of the aforementioned surface treatment solution is the lubricant adhesion method of the optical fiber bunch according to claim 8 characterized by being an acetone.

[Claim 11] The claim 8 to which a lubricous polymer agent is characterized by being a Nonion system surfactant, or the lubricant adhesion method of an optical fiber bunch given [of 10] in 1 term.

[Claim 12] The lubricant adhesion method of the optical fiber bunch characterized by providing the following. The step which creates the solution which carried out the homogeneous dissolution of the lubricous polymer agent into the solvent, mixes carbon lubricant into this solution, filters and dries after stirring, and creates processed [lubricous polymer agent] carbon lubricant. The surface treatment solution generation step which makes the solution which carried out the homogeneous dissolution of the lubricous polymer agent into the solvent. The 1st adhesion step for both ends being rigid and making it the front face of each optical fiber which the aforementioned surface treatment solution is contacted on the strand front face of an optical fiber bunch on which pars intermedia has flexibility, and forms the aforementioned optical fiber bunch in it adhere to the aforementioned lubricous polymer thin film coat mostly at homogeneity. The dryness step dried so that the aforementioned solvent may be made to evaporate from the optical fiber bunch after the adhesion step of the above 1st and the aforementioned lubricous polymer may be made to adhere to the front face of each optical fiber mostly at homogeneity, The distributed solution generation step which makes the distributed solution which carried out mixing distribution of the aforementioned processed [lubricous polymer agent] carbon lubricant in low-molecular-weight perfluoro carbon or a low-molecular-weight perfluoro polyether solvent, The 2nd adhesion step for making it the front face of an optical fiber bunch on which the aforementioned lubricous polymer adhered to homogeneity mostly adhere to the aforementioned processed [lubricous polymer agent] carbon lubricant mostly at homogeneity, The dryness step dried so that the aforementioned solvent may be made to evaporate from the optical fiber bunch after the adhesion step of the above 2nd and the aforementioned processed [lubricous polymer agent] carbon lubricant may be made to adhere to the front face of each optical fiber mostly at homogeneity.

[Claim 13] The solvent of the processing solution of the aforementioned carbon lubricant is the lubricant adhesion method of the optical fiber bunch according to claim 12 characterized by being a dimethylsiloxane system solvent.

[Claim 14] The solvent of the aforementioned surface treatment solution is the lubricant adhesion method of the optical fiber bunch according to claim 12 characterized by being ethyl alcohol.

[Claim 15] The solvent of the aforementioned surface treatment solution is the lubricant adhesion method of the optical fiber bunch according to claim 12 characterized by being an acetone.

[Claim 16] The aforementioned lubricous polymer agent dissolved in the solution which processes the aforementioned carbon lubricant and an optical fiber bunch is the lubricant adhesion method of the claim 12 characterized by being a Nonion system surfactant, or an optical fiber bunch given

[of 15] in 1 term.

[Claim 17] The lubricant adhesion optical fiber bunch characterized by the bird clapper from the carbon lubricant to which homogeneity adhered mostly the front face of each optical fiber which forms the aforementioned optical fiber bunch in the optical fiber bunch in which both ends are rigid and pars intermedia has flexibility on the wrap lubricous polymer thin film coat and the aforementioned lubricous polymer thin film coat.

[Claim 18] The lubricant adhesion optical fiber bunch according to claim 17 characterized by the aforementioned carbon lubricant being processed [lubricous polymer agent] carbon lubricant [finishing / processing by the lubricous polymer agent].

[Translation done.]